

tumours by making the vein and capillary walls of that area less permeable to oxygen and nutritive material and thus bringing about the malnutrition of the tissues that when experimentally produced in rats resulted in tumour.

2. The existence of cyanogen in tumours seems to indicate that its known action on the oxygen catalyst probably causes a continuation of the deficiency of oxygen initiated by the indigo, and would thus be responsible not only for increased growth at the original site but

also for metastases at more distant sites to which it might have escaped.

#### REFERENCES

1. DAVIS, J. E.: The probable rôle of calcium and indigo in cellular respiration, *Am. J. Physiol.*, 1937, 122: 402.
2. DAVIS, J. E.: The production of tumour and tumour-like growths in rats, *Canad. M. Ass. J.*, 1937, 36: 237.
3. ALLEN, A. H.: Commercial Organic Analysis, P. Blakiston's Son & Co., 1896, Vol. III, Part III, p. 429.
4. SOLLMANN, T.: A Manual of Pharmacology, W. B. Saunders Co., Philadelphia, 1920, p. 615.
5. BAUMANN, E. J., SPRINSON, D. B. AND METZGER, N.: The estimation of thiocyanate in urine, *J. Biol. Chem.*, 1934, 105: 269.
6. DIXON, M. AND ELLIOTT, K. A. C.: The effect of cyanide on the respiration of animal tissues, *Biochem. J.*, 1929, 23: 812.

### A TUBERCULOSIS SURVEY OF MANITOBA INDIANS\*

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THE Sanatorium Board of Manitoba, with the authorization of the Department of Indian Affairs, undertook in 1937 a tuberculosis survey of Indian Reserves and Indian Residential Schools of Manitoba. The work had to be fitted into the usual busy program of clinics among the white communities but by Fall six reserves and seven residential schools had been surveyed.

In all, 2,672 Indians were examined, of whom 1,856 were on reserves and 816 in schools. A complete survey of each school was made; but on the reserves it was not possible to examine everyone, for in each instance various activities such as hunting, fishing and visiting took a number away. However, an effective method of attack and splendid cooperation usually resulted in an almost complete turnout of all at home, so that a good cross-section of each reserve was obtained, with the sexes equally divided and ages ranging from one year to over one hundred. The average clinic attendance for each reserve was 75 per cent of the total population. About one-fifth of the 15,000 Indians in the province live on the reserves that were surveyed. Inasmuch as approximately half of Manitoba's Indians live in the hinterland it may be considered that the present survey represents about two-fifths of the total Indian population who have any significant contact with white communities.

The opinion that Indian tuberculosis is a

menace to white people is widely held and would seem well founded, and has certainly been a potent factor in the present campaign for investigation. Yet it has not been based altogether on statistical evidence, and a brief study of the tuberculosis death rates of four reserves in this survey compared with those of the adjacent communities gives rather surprising results. The average death rate for the reserves is 1,020 per 100,000, while that of the surrounding municipalities is 51 per 100,000, which is definitely lower than the whole death rate of 59 per 100,000 for the province, including Indians. In the case of the Oak River Reserve, where the surrounding population contains few half-breeds, the rates are respectively 727 per 100,000 and 26 per 100,000. These figures, though not conclusive, are interesting in view of the general opinion that reserves are a menace to surrounding communities.

The purpose of this survey was primarily to ascertain accurately the incidence of tuberculosis infection and disease among the Treaty Indians. Upon this point there has been endless speculation but no statistical knowledge to temper the impression that the Indian was still overwhelmingly scourged by the disease. Identification of those suffering from tuberculosis was a further aim. Finally, it was hoped that the data compiled would serve as a foundation for a future program of prevention and treatment.

In choosing the reserves for survey we were influenced by accessibility, which also usually meant proximity to white populations, by the interest and expected cooperation of the doctor

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attending the reserve, and by the locations which we considered would give a fair sample for the province. Oak River and Long Plains were prairie reserves in the central and southern part; The Pas Reserve brought us to the Northern Indian; Fisher River and Pequis to the Indian between Lake Winnipeg and Lake Manitoba, and Fort Alexander to the Indian of eastern Manitoba along the Winnipeg River. The three main tribes of Cree, Saulteaux and Sioux were well represented, as were also the Protestant and Roman Catholic denominations.

Our routine investigation consisted of the giving and reading of the tuberculin test (1/10 mg. O.T. intradermally), the taking of blood for a Wassermann test, a medical history (although usually meagre), and a physical examination particularly of the chest and the upper respiratory tract. Those who reacted positively to tuberculin had a single P.A. chest film as well as all to whom we were not able to give tuberculin. Bone and joint films were made when indicated. Films were developed on return to the Sanatorium, where the reports were completed.

Since conditions and findings in the resi-

dential schools and on the reserves are not to be compared each group will be dealt with separately.

These tables record and present our findings and require no special elaboration. It is noteworthy that of the 1,856 reserve Indians only 57, or 3 per cent, had glandular tuberculosis, which is in striking contrast to conditions in this respect in the 1880's as reported by Dr. R. G. Ferguson. He states that adenitis was the most impressive type of tuberculosis when the disease was in its acute epidemic stage and affected all ages. In 1906 at the Qu'Appelle School 19.5 per cent were operated on for glands and during the first 25 years of the epidemic physicians reported one out of three to have been suffering from tuberculous adenitis.

The 816 residential school children were from seven schools, all under the auspices of the church, four Protestant and three Roman Catholic. As to health in general, hygiene and nutrition, the schools are not to be compared with the reserves. The former have also the advantages of constant supervision and better medical attention; their quarters are clean, food wholesome and clothing adequate, so it is not surprising that the schools present a much less serious problem. The children almost all gain weight rapidly, and usually their general health is remarkably improved after admission. On the other hand, a child "spreader" in a school can do much more harm than if on a reserve. Yearly surveys of the residential schools and the removal of infectious cases are very important. Since 1929 nearly 2,000 examinations of Indian residential school children have been made in Manitoba, and with the removal or isolation of infective cases the reduction year by year in new cases has been striking; in fact in one school of 140 pupils only one new case has been found during the last three sessions. One or a few open cases in a school can spread infection throughout, which was demonstrated in a survey of one school last fall. In this school 4 children were found with active pulmonary tuberculosis, although in none far advanced, and 91 per cent of the children of the whole school reacted positively to tuberculin as compared to from 70 to 75 per cent for the children in the other schools.

Tables I and II analyze the pulmonary tuberculosis found as to extent and activity of disease. Of the pulmonary cases on the reserves 32 per cent had active disease, far advanced in

TABLE I.

RESERVES			
Total examined .....	1,856		
Tuberculosis .....	216 or 11.6	per cent	
Pulmonary .....	142 or 7.6	" "	
Glandular .....	57 or 3.0	" "	
Other non-pulmonary .....	17 or 1.0	" "	
Requiring sanatorium treatment... which is 25 per cent of those found with tuberculosis.	54 or 2.9	" "	
Calcified tracheo-bronchial glands and healed primary lesions....	279 or 15.0	" "	
Tuberculin test positive in.....	72.8	" "	
Wassermann test positive in.....	4.75	" "	
SCHOOLS			
Total examined .....	816		
Tuberculosis .....	35 or 4.2	per cent	
Pulmonary .....	29 or 3.5	" "	
Cervical adenitis .....	3 cases		
Bone and joint.....	2 cases		
Peritonitis .....	1 case		
Requiring sanatorium treatment... which is 23 per cent of those found with tuberculosis.	8 or 1.0	" "	
Calcified tracheo-bronchial glands and healed primary lesions....	284 or 34.8	" "	
Tuberculin test positive in.....	78.7	" "	
RESERVES AND SCHOOLS COMBINED			
Total examined .....	2,672		
Tuberculosis .....	251 or 9.39	per cent	
Requiring sanatorium treatment... which is 25 per cent of those found with tuberculosis.	62 or 2.3	" "	

TABLE II.  
PULMONARY TUBERCULOSIS (RESERVES)

Reserve	Active			Doubt. act.			Quiescent			Apparently arrested			Apparently cured			Total
	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	
Oak River.....	4						1					5			1	11
Long Plains.....	1	1			2						2	2				8
Fisher River.....	2	2		1	2	1		1	3		3	7		1	3	26
Peguis.....	7	8			1	2	1	2	3		2	1			3	30
The Pas.....	6	3	1		1	1		1	10			10			1	34
Fort Alexander...	5	3	3		4	2	1	2	5	1		6			1	33
Total.....	25	17	4	1	10	6	3	6	21	1	7	31	0	1	9	142

PULMONARY TUBERCULOSIS (RESIDENTIAL SCHOOLS)

School	Active			Doubt. act.			Quiescent			Apparently arrested			Apparently cured			Total
	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	Fa	Ma	Min	
Brandon.....									2			2				4
Portage.....					1											1
Elkhorn.....		1	3			1			3		2	2				12
Birtle.....			1						1			3				5
Sandy Bay.....			2						1							3
Fort Alexander...																0
Camperville.....			2					1	1							4
Total.....	0	1	8	0	1	1	0	1	8	0	2	7	0	0	0	29

Fa=Far advanced. Ma=Moderately advanced. Min=Minimal.

the majority, and in the schools, although approximately the same percentage (31) were considered active, none were in the far advanced stage, only one moderately advanced, and the others minimal. From the point of view of seriousness to life and the propagation of the disease residential schools present a much less worrying and much more controllable problem than do the reserves.

Of the 1,856 Indians examined on the reserves 1,021 were given a tuberculin test, and of these 744, or 72.8 per cent, were positive. In two of the residential schools tuberculin was not given, but it was to all in four schools, a total of 583, with 459 or 78.7 per cent, showing a positive reaction.

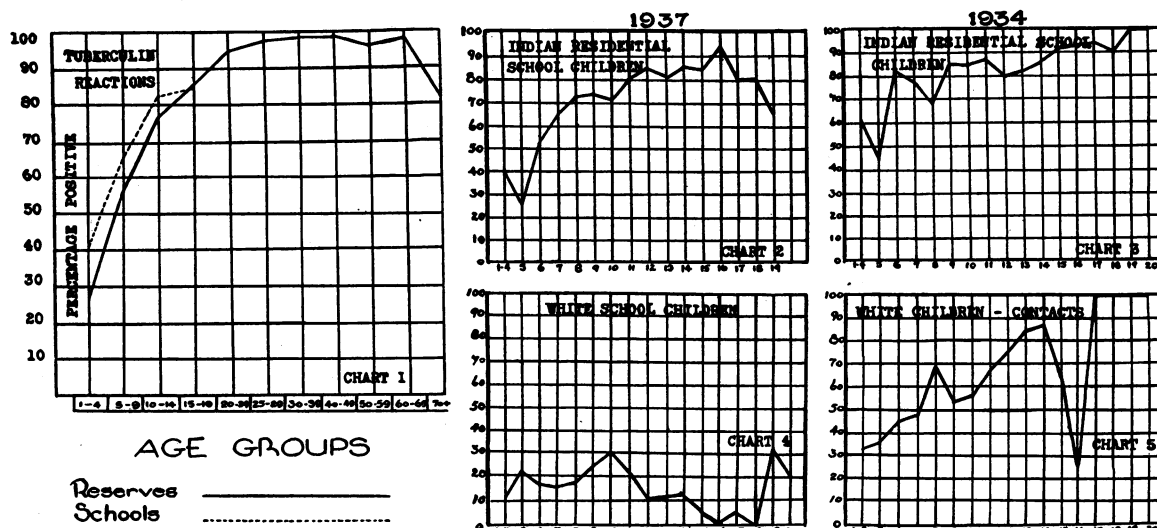
Charts 1 to 5 analyze the tuberculin reactions in age-groups and show the increase as age advances. In the one to four-year group of

over 200 children on the reserves 28.5 per cent were positive; from 5 to 9 years the percentage doubled; from 10 to 14 years 77.5 per cent reacted; and by the age of 20 years, 95 per cent were positive. In a group of 40 over 70 years of age the positives dropped to 82 per cent. There was a slightly higher percentage of reactors among the school children than among those on reserves, but the rate of increase was the same for both. In 1934 Dr. H. Meltzer, of the Manitoba Sanatorium, made a tuberculosis study of 824 Indian residential school children, and, for comparison, I am showing the tuberculin curve for that group, and also the interesting comparison with white school children and white children contacts. In the 1937 series 80 per cent was not reached until 11 years of age, but in the 1934 series 80 per cent were positive at six. After 16 the present series showed a

decrease of reactors. The white contacts attain as high a reaction rate but not quite so early as the Indian children.

Our method of survey, which included house to house visits to administer tuberculin, offered ample opportunity to study general economic and hygienic conditions, means of livelihood, intelligence and Indian character. All these factors have a direct bearing on the problem in hand and our findings were briefly as follows. Housing and general hygienic conditions were uniformly poor, though in isolated cases quite good. No one reserve had any decided advantage over the others in this regard, considerable variation in living conditions being the rule. Fully 50 per cent of the houses had only mud floors. Overcrowding, poor ventilation, un-

white people. There is a native stubbornness and intolerance to interference that makes clinic work difficult but which may quite suddenly give way to an almost tribal migration of opinion in a favourable direction, prompted by a minor shift in tactics that catches the public fancy. This same dual personality reaction is believed to influence the Indian in all his relations and will help to shape his course in the fight against tuberculosis. Though showing unbounded patience in the pursuit of his own activities of hunting and fishing, he is not liable to have the white man's patience in a long struggle against disease. Being blessed with a natural indolence should make him an ideal cure-chaser if he were not such an easy prey to periods of undisciplined activity. An abundance of natural intelligence



cleanliness, and an abundance of flies and other pests were the rule and made a perfect setting for the spread of disease. The Indian is still a wandering wigwam dweller at heart, and adapts himself poorly to living in houses. Means of livelihood include hunting, fishing, trapping, berry-picking, lumbering and agriculture. A few of the prairie reserves farm rather well but the majority do poorly. Stock, when kept, are neglected, and there is usually a scarcity of milk even for child feeding. The Indian does not plan beyond his immediate wants, so, in spite of Federal aid, he is continually passing through alternating cycles of abundance and famine, which tend to undermine health and resistance.

We were particularly struck in our dealings with Indians by their paradoxical character, for as a rule conflicting attributes seemed to make up their personality more frequently than in

is often dissipated by lack of direction to thinking and a host of superstitions which are still unbelievably common. It is hoped that time and education will correct many of these conflicting qualities, which, though somewhat intangible, are important factors in the problem of Indian tuberculosis.

In an anti-tuberculosis campaign among the Indians social and economic factors as well as medical need to be considered. Fundamentally the same principles should be followed as among the white people. The ideal program would provide for the removal of all known infective cases from households where there are children; the isolating and keeping comfortable of those who are hopelessly ill; the treating in sanatoria, educating, and attempting to restore to health those with less severe tuberculosis; surveys, routine examinations of contacts and suspects;

and an educational campaign to prevent tuberculosis and lead to its early discovery; the gradual improving of housing and hygiene and the provision of proper food to bring up a stronger and more resistant rising generation. Although it is generally considered that the

Indian has poor natural resistance to tuberculosis it was interesting to observe the large number who had healed their disease. If given the same opportunity as the white man the Indian might respond to preventive and curative measures almost as well.

## Case Reports

### DELAYED EXCRETION OF SULPHANILAMIDE IN A CASE OF PNEUMONIA WITH RENAL FAILURE\*

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The following case demonstrates the importance of careful chemical investigation when patients are treated with sulphanilamide or its allied compounds. The findings relevant to the sulphanilamide treatment only will be discussed.

A male, aged 48 years, was admitted to the medical service of Dr. A. H. Gordon on March 28, 1938, with pneumonia complicated by an acute exacerbation of a chronic nephritis. The sputum contained pneumococci and hæmolytic streptococci. Marked impairment of renal function was shown by the high urea nitrogen and creatinine contents of the blood. (See Table).

According to subsequent studies the pneumonia was probably due to the pneumococcus, but because of the finding of hæmolytic streptococci at the first examination, sulphanilamide treatment was instituted the following day (March 29th).

It will be noted that the total sulphanilamide content of the blood reached 14.1 mg. per 100 c.c. on April 1st. On this day it was also found that the impairment of renal function was more marked than on admission. In view, therefore, of the known potential toxicity of sulphanilamide and the possibility of still more accumulation in the blood due to the impaired kidneys the drug was discontinued at 12 noon on the above date (April 1st).

It will be observed that the excretion of the drug was as slow as anticipated; its concentration in the blood remained approximately the same for four days, and a trace was still found as late as seventeen days after its use had been discontinued; whereas, with normal kidney function, most of the drug is excreted within two or three days after its administration.

A fact to be emphasized is that the conjugated form of sulphanilamide, although presumably less toxic than the free form, is toxic. It should be observed that, though the proportion of the conjugated compound had gradually increased, a diffuse maculo-papular eruption appeared on the skin on April 7th, six days after the sulphanilamide had been discontinued, and when the conjugated compound accounted for the major portion (60 per cent) of the drug in the blood. The rash persisted for fifteen days, though the free form of the compound continued to decrease and disappeared entirely within seven days after the appearance of the rash. It should be noted, however, that the conjugated form of the compound was still present four days after the free form had disappeared.

Except for its long duration, there was nothing re-

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TABLE I.

SHOWING DOSAGE OF SULPHANILAMIDE, COURSE OF SKIN RASH, AND RESULTS OF RENAL FUNCTION TESTS AND QUANTITATIVE ESTIMATIONS OF SULPHANILAMIDE CONTENT OF BLOOD IN A CASE OF PNEUMONIA WITH RENAL FAILURE (Hospital No. 3333/38)

Date	Urea nitrogen (mg. per 100 c.c. blood)	Creatinine (mg. per 100 c.c. blood)	Sulphanilamide* (mg. per 100 c.c. blood)			Skin rash	Dosage of sulphanil- amide (grains per 24 hours)
			Total	Free	Con- jugated		
March							
28	34	2.30	...	...	...	0	0
29	...	...	...	...	...	0	50
30	...	...	11.1	7.1	4.0	0	75
31	...	...	16.2	14.6	1.6	0	55
April							
1	105	4.22	14.1	8.5	5.6	0	20
2	101	3.61	18.0	10.4	7.6	0	0
3	105	3.15	15.4	7.9	7.5	0	0
4	95	3.00	16.0	7.3	8.7	0	0
5	95	2.75	16.8	5.6	11.2	0	0
6	98	2.94	7.8	3.9	3.9	0	0
7	98	2.94	5.0	2.0	3.0	+	0
8	98	3.06	3.9	1.7	2.2	++	0
9	102	2.88	2.3	0.8	1.5	+++	0
10	...	...	...	...	...	+++	0
11	90	2.65	2.0	0.6	1.4	+++	0
12	84	2.50	1.9	trace	1.9	+++	0
13	...	...	1.3	trace	1.3	+++	0
14	67	2.14	1.0	0	1.0	++	0
15	...	...	trace	0	trace	++	0
16	57	1.93	trace	0	trace	++	0
17	...	...	...	...	...	++	0
18	48	1.92	trace	0	trace	+	0
19	...	...	...	...	...	+	0
20	49	2.02	0	0	0	+	0
21	...	...	...	...	...	+	0
22	70	2.68	...	...	...	+	0
23	...	...	...	...	...	0	0

\*Estimated by Marshall's technique (*J. Bio. Chem.*, 1937, 122: 263).

markable about the rash; it was the usual type characteristic of the drug. It, however, was a sign of toxicity and indicated the necessity of careful search for other toxic manifestations—agranulocytosis, acute hæmolytic anæmia, toxic hepatitis, etc.—until the last trace of the drug had disappeared from the blood. The subsequent progress was, however, uneventful.

The object of this report, therefore, is to emphasize the importance of tests of renal function and frequent estimations of the sulphanilamide content of blood in cases with renal damage. Had the drug not been discon-